

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

Floodwater Diversion (FT) No. 400

Definition

A graded channel with a supporting embankment or dike on the lower side constructed on lowland subject to flood damage.

Purpose

To divert floodwater from lowlands by the construction of a graded channel on the lowlands.

Conditions Where Practice Applies

This practice is applicable if:

1. Floodwater originating outside the lowland area to be protected is causing damage to agricultural land, crops, or improvements or is expected to cause damage to improvements to be made in the area.
2. An adequate outlet for the design flow is available, either by gravity flow or by pumping. The outlet shall be suitable for the quality and quantity of water and sediment to be disposed of, with consideration of possible damages above or below the point of discharge that might involve legal actions under state law. The outlet can be a floodway (404) or a natural channel, river, lake, bay, or tidal estuary.
3. Land to be protected is suitable for agriculture within its capabilities after installation of required conservation practices.

Federal, State, and Local Laws¹

Design and construction activities shall comply with all federal, state, and local laws, rules, and regulations governing pollution abatement, health, and safety. The owner or operator shall be responsible for securing all required permits or approvals and for

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performing in accordance with such laws and regulations. NRCS employees are not to assume responsibility for procuring these permits, rights, or approvals, or for enforcing laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required rights or approvals to construct, operate, and maintain the practice.

Permits may be required from the following agencies:

- 1. West Virginia Department of Health***
- 2. West Virginia Department of Agriculture***

Planning Considerations

Water Quantity

1. Effect on the water budget, especially on volumes and rates of runoff, evaporation, deep percolation, and ground water recharge.
2. Effects on changes in plant growth and transpiration because of changes in the amount of soil water in the vicinity of the structure.

Water Quality

1. Effects of the movement of sediment and soluble and sediment-attached substances or other toxins that would be carried by runoff.
2. Effect of erosion, including the downstream stability on streambanks and streambeds.
3. Effects of changes in ground water contamination by soluble substances because of decreases in infiltrating floodwater.

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4. Effects on the visual quality of downstream water resources.

Design Criteria

Location. The floodwater diversion shall be located to protect the maximum area of lowland, consistent with economic limitations, topographic requirements, and the desired slope of the hydraulic gradeline.

In selecting the location for floodwater diversions, consideration shall be given to the preservation of existing fish and wildlife habitat, trees of significant value for wildlife food, dens or shelter, and existing visual resources.

Capacity. Floodwater diversions that are to protect agricultural land shall have the capacity to carry the peak runoff to be expected from a 10-year 24-hour frequency storm. If farmsteads, public roads, or other improvements are within the area to be protected, the design capacity shall be consistent with the hazard involved but shall not be less than the peak flow from a 25-year 24-hour frequency storm.

Hydraulic gradeline. The hydraulic gradeline of the floodwater diversion shall tie in to the elevation of water in the outlet expected for the frequency storm selected for design, and shall be established with due regard for damages that may occur on the opposite side of the floodwater diversion from the supporting embankment. It shall have a slope in the direction of flow that will result in a velocity that will not cause excessive erosion or sedimentation.

Cross section. The design cross section shall be set below the design hydraulic gradeline and shall include the total cross-sectional area bounded by the embankment, the berm between embankment and channel, the channel, and the flow area on the opposite side of the channel from the embankment.

Velocity. If site conditions indicate that erosion is likely to be a hazard because of a higher velocity resulting from a lower roughness coefficient immediately after construction and before establishment of vegetation, such lower value of roughness coefficient shall be

estimated. The resultant velocities shall be considered in designing the channel and planning protective measures. The criteria for Open Channel (582) regarding channel stability, velocity, and roughness coefficient shall be followed.

The maximum permissible design velocity shall be based on site conditions and determined by procedures described in TR-25, Design of Open Channels. A desirable minimum velocity is 1.5 ft/s. On flat grades where the design velocity is below this value, the cross section shall be adjusted to obtain the most efficient section that depth and maintenance methods permit.

Side slopes for channels shall not be steeper than listed in the following table:

Material	Side Slope (horiz. to vert.)
Silt or sandy silt	3 to 1
Silt, or sand, with clay binder	2 1/2 to 1
Clay	2 to 1
Solid rock	1/4 to 1
Cemented gravel	1 to 1

Berm and embankment. The minimum berm width between channel and embankment shall be based on the depth of the channel:

Depth of channel ft	Minimum berm ft
2-4	4
4-6	6
6-8	10
More than 8	15

Wider berms than indicated should be used if site conditions permit.

The embankment may be constructed from the channel excavation or from suitable borrow.

The design height of the embankment shall be the design water depth plus a freeboard of at least 2 feet. The constructed height shall be the design height plus an allowance for settlement based on consideration of soil material and the

anticipated compaction during construction, but such allowance shall be no less than 5 percent of the design height.

The minimum requirements for the cross section of the embankment where fill is compacted by hauling or special equipment shall be:

Design water height ft	Min. top width ft	Steepest side slope
0-6	6	1.5:1
6-12	8	2:1

If because of soils or water conditions it is impractical to compact the embankment with hauling or special equipment, dumped fill may be used. Dumped fill shall have minimum cross section dimensions incorporated within the fill as follows:

Design water height ft	Min. top width ft	Steepest side slope
0-6	10	2:1
6-12	14	2.5:1

Side slopes of 3:1 on waterside and 2:1 on landside may be used instead of 2.5 for both slopes.

For dumped fills, the minimum allowance for settlement shall be 10 percent.

Vegetative cover. If needed, an adequate cover of grasses shall be established on the embankment to protect it against erosion by flood flows, wave action, or rainfall and runoff. Seedbed preparation, seeding, sprigging or sodding, fertilizing, mulching, and fencing shall comply with recommendations in applicable technical guides.

Maintenance access. Maintenance access shall be provided as specified in the standard for Open Channel (582).

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE GENERAL SPECIFICATIONS

Floodwater Diversion

Plans and Specifications

Plans and specifications for constructing floodwater diversions shall be in keeping with this standard and shall describe the requirements for construction to achieve the intended purpose.

Specifications may be developed from NEH-20, 700 Series, or other applicable material, as appropriate.

Operation and Maintenance

An operation and maintenance plan shall be prepared for each floodway diversion. The plan shall give minimum requirements to maintain the practice and keep it operational for the design life. The plan should also consider fish and wildlife habitat preservation, water quality, and visual resource quality.

Principal items that should be included in an operation and maintenance plan are listed below:

- 1. Equipment and methods that are necessary for maintenance.***
- 2. Herbicides that may be used and estimated annual cost thereof.***
- 3. Annual inspection to detect maintenance needs.***
- 4. Time of year that maintenance should be performed.***
- 5. Inspection after any storm event that exceeds design capacity.***
- 6. Repairing and seeding of bare areas that have appeared along the channel or embankment.***

¹Bold italics is information added to the National standard by West Virginia.

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Site Preparation

The entire width of the site for the floodwater diversion, including channel, berm, and embankment, shall be cleared of stumps, roots, brush, and debris and selectively cleared of trees and boulders. All channel banks and sharp breaks shall be sloped no steeper than 1:1 unless such sloping would likely result in changing a stable slope into an unstable slope. Topsoil high in organic matter shall be removed. The ground surface where the embankment is to be placed shall be thoroughly scarified before placement of the embankment material.

Construction operations shall be carried out in such a manner that erosion and air and water pollution are minimized and held within legal limits.

Vegetation shall be established as specified in the plans.

Excavation and Construction of Embankment

Excavation of the channel and placement of spoil in the embankment shall progress simultaneously from the outlet in an upstream direction. The channel shall be excavated to the lines and grades shown in the plans and as staked in the field, and the embankment shall be built to the dimensions specified in the plans and as staked in the field. If the excavation and fill required do not balance, the responsible technician shall specify the areas where borrow is to be obtained for fill or the place and manner of disposition of excess excavated material.